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Hrvatska/Croatia
Telefon/Phone ++385/(0)1 61 50 250
Fax ++385(0)1 60 55 806
e-mail: urednistvo.prilozi@iarh.hr
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A SPOONFUL OF STEW: DIETARY PRACTICES OF THE LASINJA CULTURE POPULATION IN EASTERN CROATIA REVEALED BY ORGANIC RESIDUE ANALYSIS OF CERAMIC SPOONS FROM ČEPINSKI MARTINCI

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MATEJA HULINA
Institut za arheologiju
Jurjevska ulica 15
HR–10000 Zagreb
mhulina@iarh.hr
ORCID 0009-0007-6026-6707

HRVOJE KALAFATIĆ
Institut za arheologiju
Jurjevska ulica 15
HR–10000 Zagreb
hrvoje.kalafatic@iarh.hr

CYNTHIANNE SPITERI
Dipartimento di Scienze della Vita e Biologia dei Sistemi
Università degli Studi di Torino
Via Accademia Albertina 13
I–10123 Turin

Eberhard Karls Universität Tübingen
Institut für Ur- und Frühgeschichte und Archäologie des Mittelalters
Burgsteige 11
G–72070 Tübingen
cynthianne.spiteri@unito.it
ORCID 0000-0003-1773-3895

Pribor za jelo i kuhinjski pribor mogu pružiti obilje informacija o prehrani zajednica u prošlosti. Keramičke žlice jedan su od tipičnih keramičkih oblika lasinjske kulture. Sastojale su se od recipijenta, tuljca za nasad drške i organske drške i služile su za rukovanje ili konzumaciju hrane ili pića u tekućem i/ili kašastom obliku. Analize organskih ostataka, najčešće apsorbiranih u keramičke stijenke posuda, danas su uobičajeni dio arheoloških istraživanja i otkrivaju informacije o upotrebi posuda, kao i detalje o prehrani zajednica u prošlosti, iskorištavanju prirodnih resursa (biljaka i životinja), medicini, kozmetikci i pogrebnih rituala. U okviru ovog rada analizirano je pet žlica lasinjske kulture iz Čepinskih Martinaca, eneolitičkog naselja u istočnoj Hrvatskoj, kako bi se utvrdila vrsta sadržaja koja je njima rukovana i kako to saznanje može doprinijeti poznavanju prehrane lasinjske zajednice na tom nalazištu i na području Hrvatske, zajedno s poznatim podatcima iz botanike i zooarheologije.

KLJUČNE RIJEČI: eneolitik, lasinjska kultura, keramičke žlice, organski ostatci, prehrana

Cutlery and kitchen utensils can provide a wealth of information about the diet of past communities. Ceramic spoons are among the typical forms of the Lasinja culture. They consist of a recipient, a socket for the handle, and an organic handle, and were used for manipulating or consuming food or beverages in liquid and/or mushy form. Analyses of organic residues, most often absorbed into the ceramic walls of vessels, are a common part of archaeological research today and can reveal information about the use of the vessels, as well as details about the diet of past communities, the exploitation of natural resources (plants and animals), and aspects of medicine, cosmetics, and funeral rituals. In this paper, five spoons of the Lasinja culture from Čepinski Martinci – an Eneolithic settlement in eastern Croatia – were analysed to determine the types of contents that were manipulated with them and how this data, together with previously known zooarchaeological and archaeobotanical evidence, can contribute to our understanding of the Lasinja community's diet at that site and more broadly in Croatia.

KEY WORDS: Eneolithic, Lasinja culture, ceramic spoons, organic residues, diet

UVOD

Žlica je „pomagalo za zahvaćanje i uzimanje u usta tekuće i žitke hrane" (HJP). Sastoji se od okruglog ili ovalnog, više ili manje udubljenog (konkavnog) dijela – recipijenta i drške ili tuljca za nasad organske drške. Žlice mogu biti izrađene od različitih materijala kao što su drvo, kost, keramika, metal, plastika ili silikon. Možemo pretpostaviti da su se u nekom obliku upotrebljavale od kad su ljudi počeli kuhati i konzumirati hranu u tekućem ili kašastom obliku. Najstarija pronađena žlica je iz špilje Avdeevo u blizini Kurska u Rusiji, iz vremena gravetijena, odnosno prije približno 23000 – 20000 godina. Izrađena je od kljove mamuta, u obliku je plitkog lista 32 x 52 mm s drškom dužine 30 mm. Uz nju je pronađena i špatula od kljove mamuta (Sánchez 2014).

Što se tiče funkcije žlica, ona je, očito vezana uz prehranu (iako se ponekad mogu koristiti i u druge svrhe, primjerice nanošenje kozmetičkih ili medicinskih proizvoda), bez obzira na različite oblike i materijale od kojih su mogle biti izrađene.

INTRODUCTION

A spoon is defined as "an aid for grasping and taking liquid and viscous food into the mouth" (HJP). It consists of a round or oval, more or less concave part – the recipient – and a handle or socket for attaching an organic handle. Spoons can be made from a variety of materials, such as wood, bone, ceramics, metal, plastic, or silicone. We can assume that spoons have been used in some form since people began to cook and consume food in liquid or mushy form. The oldest known spoon was discovered in the Avdeevo cave near Kursk, Russia, and dates to the Gravettian period, approximately 23,000–20,000 years ago. This spoon is made of mammoth tusk in the form of a shallow blade measuring 32x52 mm with a handle measuring 30 mm. A spatula made of mammoth tusk was also found alongside it (Sánchez 2014).

As for the function of the spoons, it is clearly related to food – although they could sometimes be used for other purposes, such as applying cosmetic or medical products – regardless of the different shapes and materials from which they are made.

Keramičke žlice s tuljcem za nasad o kakvima je riječ u ovom radu, poznate su od neolitika, a na prostoru Hrvatske najbrojnije su za vrijeme eneolitika, osobito u okviru lasinjske kulture, gdje su uobičajene na cijelom području njezinog rasprostiranja (npr. Čataj 2020: 338–341; Dimitrijević 1979: 160; Horváth, Simon 2003; 2004; Kerman 2013; Plestenjak 2010; Samonig 2003; Tokai 2007; Virag 2005).

Jedna od najčešćih metoda proučavanja prehrane zajednica u prošlosti je analiza organskih ostataka na keramičkim posudama koja je ovdje primijenjena na pet ulomaka žlica lasinjske kulture iz Čepinskih Martinaca kako bi se utvrdilo kakva vrsta sadržaja je njima rukovana i kako to saznanje može doprinijeti poznavanju prehrane lasinjske zajednice na nalazištu, posebno s obzirom na to da analize životinjskih ostataka još nisu završene niti objavljene, a za sada su dostupni samo podatci o biljnim ostatcima. U radu donosimo rezultate ove analize i stavljamo ih u kontekst saznanja o privredi, odnosno prehrani lasinjskih zajednica na području Hrvatske.

Čepinski Martinci

Nalazište Čepinski Martinci (Dubrava) (sl. 1) nalazi se u istočnoj Hrvatskoj, jugozapadno od Osijeka i Čepina, na trasi autoceste A5 Beli Manastir – Osijek – Svilaj, a zaštitna istraživanja na lokalitetu proveo je Institut za arheologiju 2007. i 2008. godine.

Pronađeni su ostatci iz vremena eneolitika (naselje), brončanog doba (naselje i groblje) i srednjeg vijeka (naselje). Eneolitički nalazi sastoje se od naselja lasinjske kulture, kulture Retz-Gajary i naselja badenske kulture (Kalafatić 2009: 21–22).

Naselje lasinjske kulture nalazi se na blago povišenom položaju i sastoji se od nizova nadzemnih kuća koje su pravilno poredane i orijentirane u smjeru istok – zapad. Kuće su pravokutnog tlocrta, duže od 15 m i uglavnom s više prostorija, a ponekad i trijemom. Najvjerojatnije su imale krov na dvije vode. Kod većih kuća, na južnom dijelu nalazio se ukopan pravokutni prostor za skladištenje, u kojem su pronađene velike keramičke posude za zalihe, pa se pretpostavlja da je služio kao spremište hrane. Blizu kuća, na nižem dijelu naselja nalazio se niz bunara i plitko ukopanih zemunica, često povezanih s bunarom ili više njih, koje su najvjerojatnije korištene kao radni prostori (Kalafatić 2009: 21–22).

Ceramic spoons with a socket for a handle, such as those discussed in this paper, have been known since the Neolithic period. In Croatia, they are most numerous during the Eneolithic, especially within the Lasinja culture, where they are common throughout its distribution area (e.g., Čataj 2020: 338–341; Dimitrijević 1979: 160; Horváth, Simon 2003; 2004; Kerman 2013; Plestenjak 2010; Samonig 2003; Tokai 2007; Virag 2005).

One of the most common methods for studying the diet of past communities is organic residue analysis of pottery. In this study, this method was applied to five sherds of spoons of the Lasinja culture at Čepinski Martinci, aiming to determine what kinds of contents were manipulated using these objects and how this data can contribute to our understanding of the Lasinja community's diet at the site, especially since analyses of animal remains have not yet been completed or published, and only data on plant remains are currently available. In this paper, we present the results of this analysis and discuss their implications for understanding the economy and diet of the Lasinja communities in Croatia.

Čepinski Martinci

The Čepinski Martinci (Dubrava) site (Fig. 1) is located in eastern Croatia, southwest of Osijek and Čepin, on the route of the A5 Beli Manastir–Osijek–Svilaj motorway. Rescue excavations at the site were conducted by the Institute of Archaeology in 2007 and 2008.

Remains from the Eneolithic (settlement), Bronze Age (settlement and cemetery), and Middle Ages (settlement) were found. The Eneolithic finds include settlements associated with the Lasinja culture, the Retz-Gajary culture, and the Baden culture (Kalafatić 2009: 21–22).

The Lasinja settlement is located on a slightly elevated position and consists of rows of aboveground houses aligned in an east-west orientation. The houses feature a rectangular ground plan, exceed 15 m in length, and typically include several rooms – sometimes with a porch. They most likely had gable roofs. In the southern part of the larger houses, rectangular storage areas were dug into the ground and contained large ceramic pots, suggesting these spaces served as food storage. Near the houses, in the lower part of the settlement, a series of wells and shallow dugouts were found, often connected to a well or several wells, and were most likely used as working areas (Kalafatić 2009: 21–22).

S. 1 – Karta prikazuje geografski položaj Čepinskih Martinaca (podloga: T. Kaniški za Institut za arheologiju; prilagodila: M. Hulina)
Fig. 1 – Map showing the geographical location of Čepinski Martinci (base: T. Kaniški for the Institute of Archaeology; adapted by: M. Hulina)

Od pokretnih nalaza pronađeno je mnogo keramičkih posuda tipičnih za lasinjsku kulturu, životinjske kosti, kameno oruđe i nekoliko bakrenih predmeta (Kalafatić 2009: 22), no ovi nalazi nisu do sada objavljeni.

Naselje je u datirano od 4200. do 3950. g. pr. Kr., u vrijeme lasinjske kulture.

Keramičke žlice lasinjske kulture

Žlice su vrlo čest i prepoznatljiv keramički oblik u lasinjskoj kulturi i prisutne su na gotovo svakom njezinom nalazištu. Imaju veći ili manji zaobljeni recipijent i tuljac za nasad drška (npr.

Numerous ceramic vessels typical of the Lasinja culture were found, along with animal bones, stone tools, and several copper objects (Kalafatić 2009: 22). However, these finds have not yet been published.

The settlement has been dated to the period of the Lasinja culture, between 4200 and 3950 BC.

Ceramic spoons of the Lasinja culture

Spoons are a very common and recognizable ceramic form in the Lasinja culture, present at nearly every site. They feature rounded recipient – either large or small – and a socket for

Balen 2010; Čataj 2020: 338; Dimitrijević 1961: 149–150; 1979; Horváth, Simon 2003; Marković 1994; Minichreiter, Marković 2013; Tiefengraber 2004: 212). Najčešće su izrađene od keramike koja je nejednoliko pečena, narančastih i oker tonova, ponekad siva, ponekad s tamnijim linijama u presjeku, s primjesama pijeska, minerala (kvarcita i kalcita) i groga, zaglađene ili ovlaš glačane površine te su neukrašene (Čataj 2020: 61, 338). Veličina im varira od posve malih, veličine današnjih žlica, do veličine današnjih zaimača (Čataj 2020: 338).

L. Čataj (2020: 101–102) dijeli žlice lasinjske kulture na sedam tipova s podtipovima, ovisno o obliku i načina spajanja tuljca s recipijentom: (1) žlice jednostavnog obrisa s tuljcem koji se širi prema recipijentu, (2) žlice s tuljcem koji se širi prema recipijentu s kojim se spaja ispod ruba, (3) žlice jednostavnog obrisa s tuljcem jednolike širine, (4) žlice s tuljcem jednolike širine koji se s recipijentom spaja ispod njegovog ruba, (5) žlice s tuljcem profiliranog ruba, (6) žlice s kratkim tuljcem i (7) žlice s punim drškom.

Slične žlice poznate su, osim u lasinjskoj kulturi, i u okviru neolitičke lenđelske kulture, te istovremenih kultura susjednih lasinjskoj (Čataj 2020: 338–341).

Žlice s tuljcem za nasad drške, izrađene najvjerojatnije od organskog materijala (npr. drveta), osim u okviru lasinjske kulture, poznate su već od neolitika, gdje su karakteristične za lenđelsku kulturu (Čataj 2020: 340–341) i pojavljuju se na velikom broju nalazišta na području Hrvatske (Čataj 2020: 338–339) te u Sloveniji, Austriji i Mađarskoj (npr. Barna 2007: T. 7: 5, 7; Guštin 2005: 13, br. 12, 14; Horváth, Kalicz 2006: br. 46–48; Horváth, Simon 2003: Abb. 17: 17; Šavel 2006: br. 13).

Navedeni tipove žlica, prema Čataj (2020), rasprostranjeni su u okviru lasinjske kulture osim na hrvatskim nalazištima (npr. Balen, Drnić 2014; Bekić 2006; Čataj 2020: 338–341; Dimitrijević 1979; Minichreiter, Marković 2013) i na širem prostoru lasinjske kulture. Tipovi 1–3 poznati su i iz Mađarske i Slovenije, tipovi 4 i 6 iz Austrije, Mađarske i Slovenije, a tip 5 iz Mađarske (Čataj 2020: 338–341; npr. Horváth, Simon 2003; 2004; Kerman 2013; Plestenjak 2010; Samonig 2003; Tokai 2007; Virág 2005).

Žlice s punim drškom, iako nisu direktno tema ovog rada, vrijedne su spomena. Osim u okviru lasinjske kulure na području Hrvatske (Čataj 2020: 341), javljaju se i u neolitiku na nalazištima lenđelske kulture u Sloveniji (npr.

the handle (e.g., Balen 2010; Čataj 2020: 338; Dimitrijević 1961: 149–150; 1979; Horváth, Simon 2003; Marković 1994; Minichreiter, Marković 2013; Tiefengraber 2004: 212). They are most often made of unevenly fired ceramic, typically in orange or ochre hues, sometimes with grey tones, and occasionally exhibit darker lines in the cross-section. The ceramic fabric contains admixtures of sand, minerals (quartzite and calcite), and grog. The surfaces are smoothed or lightly polished. The spoons are undecorated (Čataj 2020: 61, 338). Their size ranges from that of very small modern spoons to that of modern ladles (Čataj 2020: 338).

L. Čataj (2020: 101–102) classifies Lasinja spoons into seven types (with subtypes) based on their shape and the method of connecting the handle to the recipient: (1) simple spoons with a socket that widens toward the recipient; (2) spoons with a socket that widens toward the recipient and connects to it below the rim; (3) simple spoons with a socket of uniform width; (4) spoons with a socket of uniform width that connects to the recipient below its rim; (5) spoons with a socket with a profiled edge; (6) spoons with a short socket; and (7) spoons with a full handle.

Outside of Lasinja culture, similar spoons are known from the Neolithic Lengyel culture and from neighbouring cultures contemporary with Lasinja (Čataj 2020: 338–341).

Spoons with a socket for the handle – most likely made of organic material (e.g., wood) – have been known since the Neolithic, where they are characteristic of the Lengyel culture (Čataj 2020: 340–341). They appear at a large number of Croatian sites (Čataj 2020: 338–339), as well as in Slovenia, Austria, and Hungary (e.g., Barna 2007: Pl. 7: 5, 7; Guštin 2005: 13, no. 12, 14; Horváth, Kalicz 2006: no. 46–48; Horváth, Simon 2003: Abb. 17: 17; Šavel 2006: br. 13).

According to Čataj (2020), the aforementioned types of spoons – in addition to those found at Croatian sites (e.g., Balen, Drnić 2014; Bekić 2006; Čataj 2020: 338–341; Dimitrijević 1979; Minichreiter, Marković 2013) – are widespread throughout the entire area of the Lasinja culture. Types 1-3 are also known from Hungary and Slovenia, types 4 and 6 from Austria, Hungary, and Slovenia, and type 5 from Hungary (Čataj 2020: 338–341; e.g., Horváth, Simon 2003; 2004; Kerman 2013; Plestenjak 2010; Samonig 2003; Tokai 2007; Virág 2005).

Spoons with a full handle, although not a direct subject of this work, are worth mentioning. In

Guštin et al. 2005: br. 46; Velušček 2005: 26, br. 24; 2011: sl. 4: 17) i na širem prostoru lasinjske kulture, njezinih susjednih grupa i u sklopu kulturnog kompleksa Bubanj-Sălcuţa-Krivodol (Čataj 2020: 341).

Bez obzira na različit oblik, funkcija im je svakako bila ista, vezana uz pripremu i konzumaciju hrane.

Privreda lasinjske kulture na području Hrvatske

Saznanja o privredi zajednica lasinjske kulture na području Hrvatske baziraju se na nalazima životinjskih kostiju i ostataka biljaka s nekoliko nalazišta, te analizi izotopa ljudskih kostiju.

Sa samih Čepinskih Martinaca, životinjske kosti, odnosno arheozoološki podatci još nisu objavljeni, pa donosimo podatke samo s ostalih objavljenih nalazišta. Objavljeni botanički podatci navedeni su u daljnjem tekstu.

Objavljeni životinjski ostatci iz lasinjskih nalazišta u Hrvatskoj pokazuju da među njima uglavnom dominiraju ostatci goveda (Slavča: Miculinić, Mihaljević 2003; Trbojević-Vukičević et al. 2011; Tomašanci – Palača: McClure 2020; Tomac 2024). Ostatci životinjskih kostiju iz lasinjskog sloja u Slavči, osim goveda, sadržavali su i kosti ovaca/koza (Miculinić, Mihaljević 2003: 75). Na nalazištu Tomašanci – Palača dominiraju ostatci goveda, a dobna struktura stada (najviše odraslih jedinki, zatim mlađih odraslih i mladih) ukazuje na to da su se životinje prvenstveno uzgajale radi mlijeka, odnosno mliječnih proizvoda, a tek zatim radi mesa (Tomac 2024: 113). Osim goveda, pronađeni su i ostatci svinja, ovaca/koza, psa i divljih životinja – jelena, srne, bizona (McClure 2020: 258–259; Tomac 2024: 63). Na nalazištu Selci Đakovački – Pajtenica zabilježeni su ukopi životinja, među kojima su ostatci goveda, ovaca/koza i pasa (Pasarić 2023).

Analize stabilnih izotopa ugljika (C) i dušika (N) provedene na ljudskim kostima individua pokopanih u masovnoj grobnici lasinjske kulture u Potočanima pokazale su da su meso i mlijeko imali veću ulogu u njihovoj prehrani nego kod okolnih populacija (McClure et al. 2020: 8).

Pripadnici lasinjskih zajednica na području istočne Hrvatske bavili su se stočarstvom, uglavnom uzgojem goveda, a životinje su se upotrebljavale za meso, kao i zbog mliječnih proizvoda i mlijeka.

addition to being found at Lasinja culture sites in Croatia (Čataj 2020: 341), they appear in the Neolithic at the Lengyel sites in Slovenia (e.g., Guštin et al. 2005: no. 46; Velušček 2005: 26, no. 24; 2011: Fig. 4: 17) and in the wider area of the Lasinja culture, its neighbouring groups, and within the Bubanj-Sălcuţa-Krivodol cultural complex (Čataj 2020: 341).

Regardless of their different forms, their function was almost certainly the same: related to the preparation and consumption of food.

Economy of the Lasinja Culture in Croatia

Information about the economy of Lasinja culture communities in Croatia is based on animal bone and plant remains from several sites, as well as isotope analyses of human bones.

The archaeozoological data (animal bones) from Čepinski Martinci have not yet been published; therefore, this overview presents data only from other published sites. The published botanical data are presented below.

Published animal bones from Lasinja sites in Croatia show that a clear dominance of cattle remains (Slavča: Miculinić, Mihaljević 2003; Trbojević-Vukičević et al. 2011; Tomašanci – Palača: McClure 2020; Tomac 2024). At the site of Slavča, animal bone remains from the Lasinja layer, in addition to cattle, also included sheep/goat bones (Miculinić, Mihaljević 2003: 75). At Tomašanci – Palača, cattle remain are dominant; the age structure of the herd – comprising mostly adults, followed by sub-adults and juveniles – indicates that the animals were primarily raised for milk and dairy products, and secondarily for meat (Tomac 2024: 113). Besides cattle, the site included the remains of pigs, sheep/goats, dogs, and wild animals – deer, roe deer, and bison (McClure 2020: 258–259; Tomac 2024: 63). At Selci Đakovački – Pajtenica, animal burials containing the remains of cattle, sheep/goats, and dogs were recorded (Pasarić 2023).

Stable isotope analyses of carbon (C) and nitrogen (N) from the human bones of individuals buried in a Lasinja culture mass grave in Potočani have shown that meat and milk played a greater role in their diet compared to surrounding populations (McClure et al. 2020: 8).

Lasinja communities in eastern Croatia practiced animal husbandry, mainly cattle breeding. The animals were used for meat as well as for dairy products and milk.

In addition to animal husbandry, abundant

Osim dokaza za stočarstvo, postoje i brojniji dokazi za poljodjelstvo i iskorištavanje biljnih izvora hrane. Naime, arheobotaničke analize provedene su na brojnim hrvatskim nalazištima lasinjske kulture, uključujući i Čepinske Martince.

Na lokalitetu Čepinski Martinci zabilježeni su nalazi različitih vrsta pšenice (jednozrne: *Triticum monococcum*, dvozrnog pira: *Triticum turgidum* ssp. *dicoccum*) i ječma (*Hordeum vulgare* ssp. *vulgare*), kao i na nalazištima Jurjevac – Stara Vodenica, Potočani, Pajtenica – Velike livade, Tomašanci – Plača, Lasinja i Barbarsko (Đukić 2014: tab. 3–4; Reed 2016; 2017; 2018; 2020).

U Lasinji, Potočanima i Slavči su pronađeni i ostatci klipastog muhara (*Sertaria italica*). Osim ostataka zrnja žitarica, zabilježeni su i ostaci pljeve ili mekinja dvozrne i jednozrne pšenice (Reed 2018: 241). Pronađeni su i rijetki nalazi uljarica i mahunarki (Potočani, Čepinski Martinci – neidentificirana mahunarka, Reed 2018: 242). Zabilježeno je i divlje voće od kojeg je najčešći drijenak (*Cornus mas*), zatim šumska mjehurica (*Physalis alkekengi*) i šljiva (*Prunus* cf. *spinosa*) (Đukić 2014: tab. 6; Reed 2016; 2017: 1750–1753; 2018: 242). Na nalazištu Tomašanci – Palača pronađen je i lješnjak (*Corylus* sp.) (Reed 2020: 250). Na nalazištu Črečan u Međimurju pronađen je i grašak koji inače nije bio prisutan u objavljenim nalazima u ranom i srednjem eneolitiku (Čataj 2020: 80; Reed 2017: tab. 5).

U vrijeme lasinjske kulture u istočnoj Hrvatskoj, uzgoj žitarica temeljio se na uzgoju ječma, dvozrne i jednozrne pšenice, a vrste i načini uzgoja žitarica nisu se značajno razlikovali u odnosu na prethodna razdoblja, no može se primijetiti da je u eneolitiku prisutna manja količina biljnih ostataka nego u neolitiku, ali više biljnih vrsta. Razlike se mogu pripisati stanju sačuvanosti ili metodologiji iskopavanja jer se još uvijek na svim lokalitetima radi s vrlo malim brojem uzoraka (Reed 2016: 14; 2017: 1762; 2020: 252; 2023: 176).

Za sada, analize organskih ostataka na materijalu lasinjske lulture s područja Hrvatske još nisu objavljene.

Lasinjske zajednice na području Hrvatske uzgajale su domaće životinje – goveda, svinje, ovce/koze koje su koristili za meso, ali i za mlijeko (goveda), zatim žitarice (ječam i pšenicu u Čepinskim Martincima). Prehranu su također obogaćivali divljim biljkama i voćem, mahunarkama, a ponekad su lovili i divlje životinje.

evidence for agriculture and the exploitation of plant food sources comes from archaeobotanical analyses conducted at numerous Lasinja culture sites in Croatia, such as Čepinski Martinci.

Finds of different types of wheat – single-grain wheat (*Triticum monococcum*) and two-grain spelt (*Triticum turgidum ssp. Dicoccum*) – as well as barley (*Hordeum vulgare ssp. Vulgare*), were recorded at Čepinski Martinci, but also at Jurjevac – Stara Vodenica, Potočani, Pajtenica – Velike livade, Tomašanci – Plača, Lasinja, and Barbarsko (Đukić 2014: Tab. 3–4; Reed 2016; 2017; 2018; 2020).

Remains of foxtail millet (*Sertaria italica*) were found at Lasinja, Potočani, and Slavča. In addition to cereal grains, remains of chaff or bran from both two-grain and one-grain wheat were also recorded (Reed 2018: 241). Rare finds of oilseeds and legumes were also found (Potočani, Čepinski Martinci – unidentified legume, Reed 2018: 242). Wild fruits were recorded as well, the most common being dogwood (*Cornus mas*), followed by bladder cherry (*Physalis alkekengi*) and plums (*Prunus cf. spinosa*) (Đukić 2014: Tab. 6; Reed 2016; 2017: 1750–1753; 2018: 242). Hazelnut (*Corylus sp.*) was found at Tomašanci – Palača (Reed 2020: 250). Peas, which had not previously been present in published finds from the Early and Middle Eneolithic, were found at Črečan in Međimurje (Čataj 2020: 80; Reed 2017: Tab. 5).

During the Lasinja culture period in eastern Croatia, cereal cultivation was based on barley, einkorn, and emmer wheat. The types and methods of cereal cultivation did not differ significantly from those of earlier periods; however, it can be observed that the Eneolithic yields a smaller quantity of plant remains than the Neolithic, but a greater diversity of plant species. These differences may also be attributed to preservation conditions or excavation methodology, as very small samples continue to be used at all sites (Reed 2016: 14; 2017: 1762; 2020: 252; 2023: 176).

Organic residue analyses of Lasinja material from the territory of Croatia have not yet been published.

Lasinja communities in Croatia raised domestic animals – cattle, pigs, and sheep/goats – which they used for meat as well as milk (cattle). They cultivated cereals (barley and wheat at Čepinski Martinci) and supplemented their diet with wild plants and fruits, legumes, and occasionally hunted wild animals.

METODOLOGIJA

Danas se analize organskih ostataka rutinski obavljaju kao dio arheoloških istraživanja. Ova se metoda obično koristi za proučavanje primjerice prehrane ili upotrebe posuda vezanih uz prehranu, medicinu, pogrebne rituale, tehnologije u proizvodnji i popravljanju keramičkih posuda i općenito svakodnevnog života arheoloških zajednica. Moderne analitičke tehnike i instrumenti omogućuju otkrivanje organskih ostataka čak i u najmanjim tragovima, a pomoću ovih analiza dosad je otkriven cijeli niz različitih tvari kao što su životinjske i mliječne masti, biljna ulja i voskovi, pčelinji vosak, smole, masti morskih sisavaca, riba i dr. (npr. Charters et al. 1993; Copley et al. 2003; Craig et al. 2007; Evershed et al. 1991; 2002a; 2008; Hansel, Evershed 2009).

Radi se o analizama organskog materijala koji se apsorbirao u stijenke keramičkih posuda, a rjeđe je vidljiv na površini (Evershed 2008: 903–904). Najčešće i najbolje se u keramici sačuvaju lipidi (npr. masne kiseline, alkoholi, alkani, ketoni, steroli, acilgliceroli, esteri voska). Postoji nekoliko metoda ekstrakcije lipida iz keramike koji ovise o tome koje informacije želimo dobiti, a danas se najčešće koriste direktna ekstrakcija kiselinom u metanolu, koja je korištena i u ovom radu, te ekstrakcija otapalom. Neke od dobivenih molekula specifične su za određene izvore (npr. za životinjsku mast, mlijeko, žitarice, lisnato povrće, ribu) i upotrebljavaju se pri njihovoj identifikaciji. Takve molekule nazivaju se biomarkeri (Evershed 1993; 2008).

Analitičke metode koje se upotrebljavaju su redom: plinska kromatografija (GC), plinska kromatografija – masena spektrometrija (GC-MS) i analize stabilnih izotopa $\delta^{13}C$ iz palmitinske i stearinske kiseline metodom GC-C-IRMS (plinska kromatografija – izgaranje – masena spektrometrija omjera izotopa), kako bi se najprije utvrdila količina organskih ostataka – prvenstveno lipida, zatim da bi se identificirali kemijski spojevi, te se naposlijetku utvrdilo njihovo podrijetlo (pripadaju li npr. masti preživača, nepreživača, mlijeku, ribi).

Analize organskih ostataka na materijalu lasinjske kulture s područja Hrvatske dosad nisu objavljene, no vrijedno je spomenuti nekoliko istraživanja na eneolitičkom materijalu iz istočne Hrvatske koja su identificirala ostatke mliječnih masti, masti preživača i pčelinjeg voska u okviru vučedolske, badenske, kostolačke kulture (Miloglav, Balen 2019; Stern 2011) i kulture

METHODOLOGY

Nowadays, organic residue analysis is routinely performed as part of archaeological research. This method is commonly used to study diet, vessel use related to diet, medicine, funerary rituals, production technologies, the repair of ceramic vessels, and daily life in past communities in general. Modern analytical techniques and instruments allow for the detection of organic remains even in the smallest traces. Through these analyses, a wide range of substances have been identified, including animal fats, dairy fats, vegetable oils, leaf waxes, beeswax, resins, and marine mammal and fish fats (e.g., Charters et al. 1993; Copley et al. 2003; Craig et al. 2007; Evershed et al. 1991; 2002a; 2008; Hansel, Evershed 2009).

Analysed organic material is typically absorbed into the ceramic walls and is less often visible on the surface (Evershed 2008: 903–904). Lipids – such as fatty acids, alcohols, alkanes, ketones, sterols, acylglycerols, and wax esters – are most common and best-preserved organic materials in ceramics. There are several methods for extracting lipids from ceramics, depending on the information sought. The most widely used include direct methanolic acid extraction, which was applied in this paper, and solvent extraction. Some of the molecules obtained are specific to certain sources (e.g., animal fat, milk, cereals, leafy vegetables, fish) and are used to identify these substances. Such molecules are referred to as biomarkers (Evershed 1993; 2008).

The analytical methods used are gas chromatography (GC), gas chromatography–mass spectrometry (GC-MS), and compound-specific $\delta^{13}C$ stable isotope analysis of palmitic and stearic acids using the GC–C–IRMS method (gas chromatography–combustion–isotope ratio mass spectrometry), in order to first determine the quantity of organic residues – primarily lipids – identify specific compounds, and ultimately clarify their origins, such as whether they derive from ruminant or non-ruminant adipose fats, dairy, or fish.

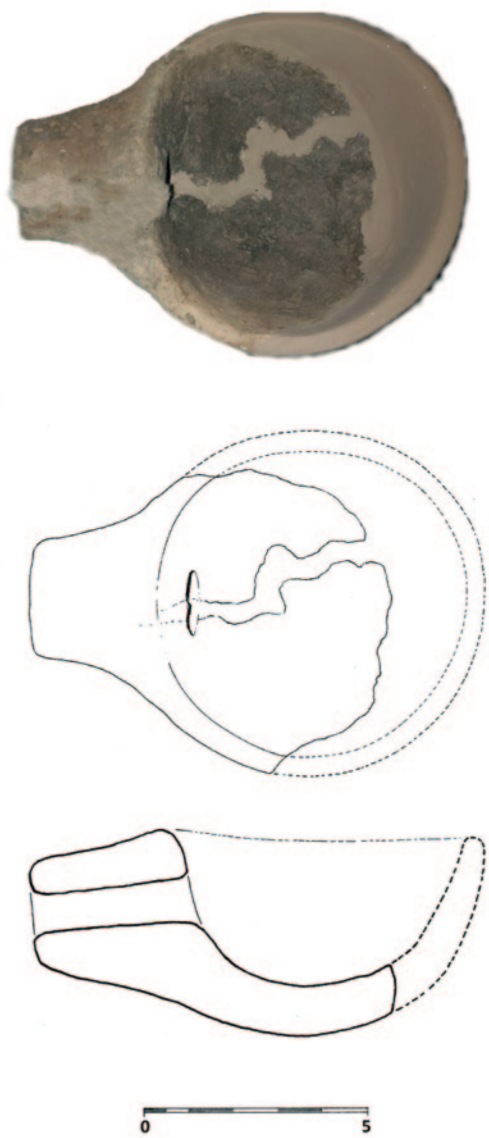
Organic residue analysis of Lasinja material from Croatia has not yet been published. However, several studies on Eneolithic material from eastern Croatia have identified residues of dairy fats, ruminant adipose fats, and beeswax from the Vučedol, Baden, and Kostolac cultures (Miloglav, Balen 2019; Stern 2011) and the Retz-

Retz-Gajary (Hulina 2020). S nalazišta Đakovo – Franjevac (Stern 2011), analizirana je i keramička žlica kasnoeneolitičke kostolačke kulture koja nije sadržavala sačuvane lipide.

Uzorci

U okviru ovog rada analizirano je pet žlica lasinjske kulture iz Čepinskih Martinaca. Sve žlice su pronađene u naselju, u otpadnim jamama, zajedno s ostatcima ulomaka keramičkih posuda i životinjskih kostiju.

Žlica uzorak CMD1 (PN-178) (sl. 2) žlica je s tuljcem za nasad jednostavnog obrisa koja se širi pre-



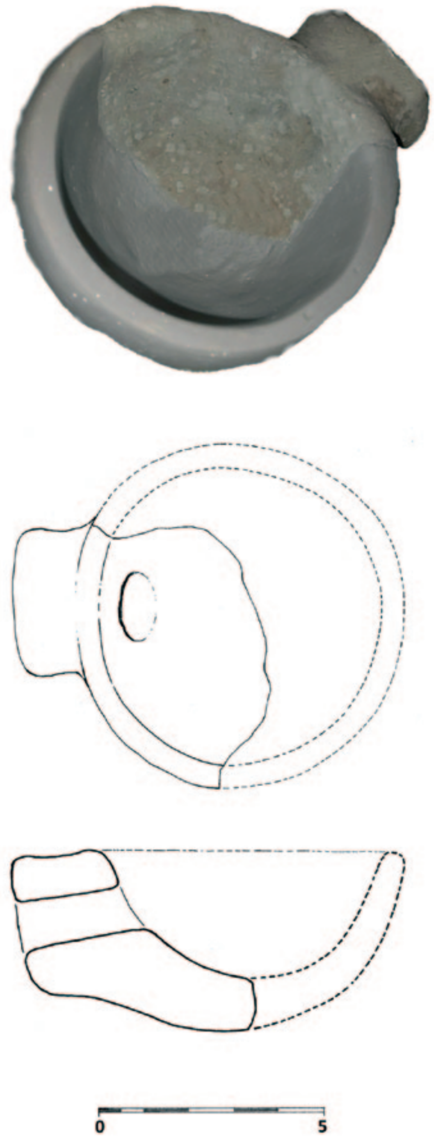
Sl. 2 – Žlica uzorak CMD1 (snimila, nacrtala i izradila: M. Hulina)
Fig. 2 – Spoon sample CMD1 (photo, drawing and made by: M. Hulina)

Gajary culture (Hulina 2020). A ceramic spoon from the Late Eneolithic Kostolac culture, found at Đakovo Franjevac, was also analysed (Stern 2011), but did not contain preserved lipids.

Samples

In this paper, five spoons from the Lasinja culture at Čepinski Martinci were analysed. All spoons were found within the settlement, in waste pits, together with pottery sherds and animal bones.

Spoon sample CMD1 (PN-178) (Fig. 2) is a simple spoon with a socket for a handle that widens toward the recipient. It is grey-brown in colour,



Sl. 3 – Žlica uzorak CMD2 (snimila, nacrtala i izradila: M. Hulina)
Fig. 3 – Spoon sample CMD2 (photo, drawing and made by: M. Hulina)

ma recipijentu, sivo-smeđe je boje, zaglađene površine, izrađena od gline s primjesama minerala. Dimenzije: duljina 10 cm, recipijent: 7,3 x 8,6 cm.

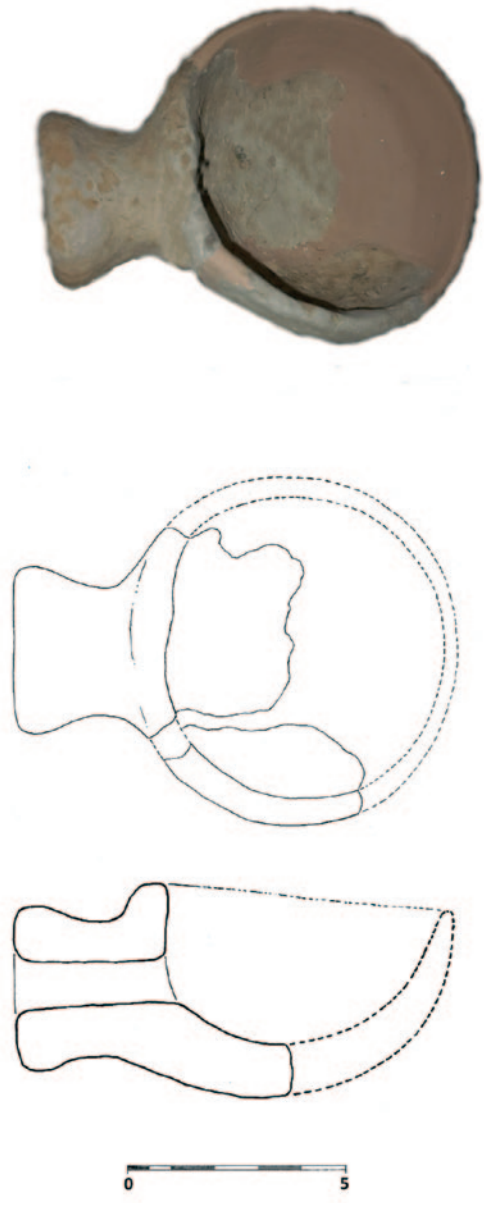
Žlica uzorak CMD2 (PN-154) (sl. 3) žlica je s tuljcem za nasad profiliranog ruba, sive boje, zaglađene površine, izrađena od gline s primjesama minerala. Dimenzije: sačuvana duljina: 5,5 cm.

Žlica uzorak CMD3 (PN-360) (sl. 4) žlica je s tuljcem za nasad profiliranog ruba, sive boje, neglačane površine, izrađena od gline s primjesama minerala. Dimenzije: sačuvana duljina 8,7 cm, duljina tuljca: 2,5 cm.

with a smooth surface, and made of clay with mineral admixtures. Dimensions: length 10 cm, recipient: 7.3 x 8.6 cm.

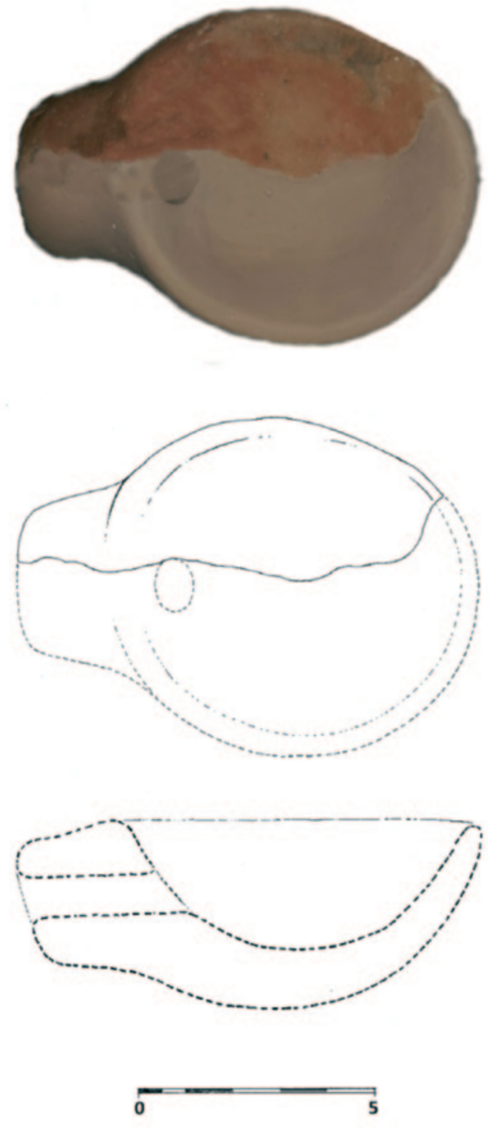
Spoon sample CMD2 (PN-154) (Fig. 3) is a spoon with a profiled edge on the socket. It is grey in colour, with a smooth surface, and made of clay with mineral admixtures. Dimensions: preserved length: 5.5 cm.

Spoon sample CMD3 (PN-360) (Fig. 4) is a spoon with a profiled edge on the socket. It is grey in colour, with an unpolished surface, and made of clay with mineral admixtures. Dimensions: preserved length 8.7 cm, length of the handle socket: 2.5 cm.



Sl. 4 – Žlica uzorak CMD3 (snimila, nacrtala i izradila: M. Hulina)

Fig. 4 – Spoon sample CMD3 (photo, drawing and made by: M. Hulina)



Sl. 5 – Žlica uzorak CMD4 (snimila, nacrtala i izradila: M. Hulina)

Fig. 5 – Spoon sample CMD4 (photo, drawing and made by: M. Hulina)

Žlica uzorak CMD4 (PN-136) (sl. 5) žlica je s tuljcem za nasad jednostavnog obrisa koja se širi prema recipijentu, narančaste je boje, zaglađene površine, izrađena od gline s primjesama minerala. Dimenzije: duljina: 8,4 cm, recipijent: duljina 5,6 cm, dubina 3,2 cm.

Žlica uzorak CMD5 (PN-202) (sl. 6) žlica je s tuljcem za nasad jednostavnog obrisa koja se širi prema recipijentu i spaja s njim ispod ruba, sivo-smeđe je boje, zaglađene površine, izrađena od gline s primjesama minerala. Dimenzije: sačuvana duljina 9,5 cm, duljina tuljca: 1,5 cm, recipijent: sačuvano 7 x 7,5 cm.

Ekstrakcija lipida

Analiza organskih ostataka (lipida) provedena je na Sveučilištu u Tübingenu. Za analizu je korištena uobičajena metodologija ekstrakcije (direktna ekstrakcija kiselinom) poznata iz literature (Correa-Ascencio, Evershed 2014).

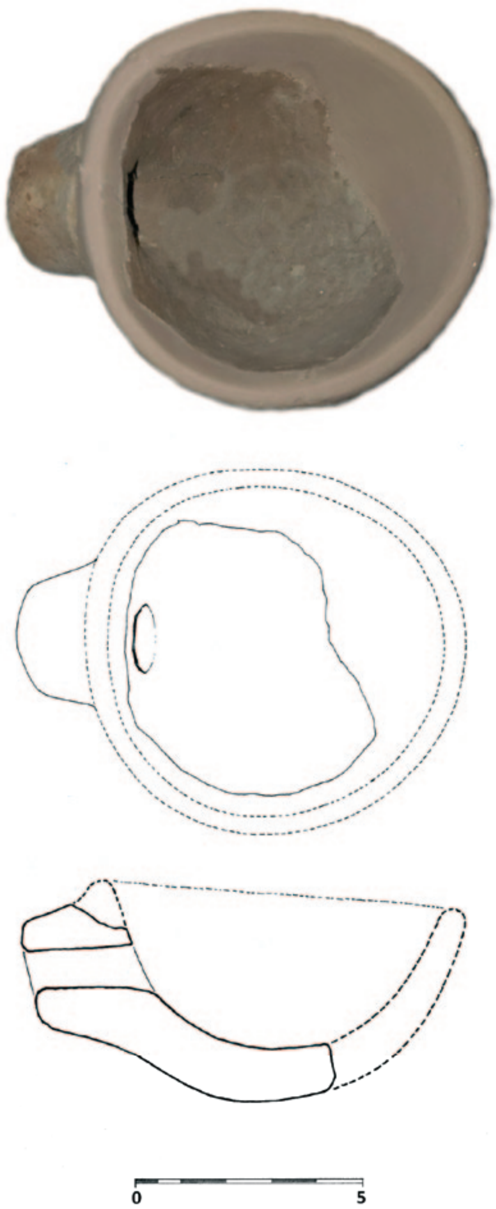
Uzorci su najprije usitnjeni u prah mini bušilicom tako da je prvo uklonjen površinski sloj da se izbjegnu kontaminacije. Za svaki je uzorak prije analize pažljivo s vanjske strane prikupljen oko 1 gr praha koji je stavljen u staklene epruvete. Svakom uzorku je najprije dodano 20 µg n-tetratriakontana (0,2 µg/µl) kao unutarnji standard za kvantifikaciju, a zatim 4 ml metanola, nakon čega su ultrazvučno obrađeni 15 min, dodano im je 0,8 ml sumporne kiseline (H_2S0_4) te su zagrijavani na 70 °C četiri sata. Nakon toga uzorci su centrifugirani 5 min na 3000 okretaja u minuti te je tekući dio odvojen u čiste epruvete. Lipidi su ekstrahirani s 3 x 2 ml n-heksana i filtrirani kroz pipetu sa staklenom vunom i K_2CO_3. Dobiveni potpuni ekstrakti lipida (TLE) odvojeni su u alikvote i posušeni pod strujom dušika na 40 °C. Uz svaku seriju uzoraka pripremljena je, ekstrahirana i analizirana slijepa proba i mješavina izotopski izmjerenih standarda (mješavina palmitinske kiseline – $C_{16:0}$ i stearinske kiseline – $C_{18:0}$). Uzorci su prije analize skladišteni u zamrzivaču na temperaturi od -20 °C. Nakon ovakve ekstrakcije, dobivene su masne kiseline u obliku metil estera (FAME).

Prije GC-FID i GC-MS analize alikvoti uzoraka su derivatizirani s 40 µl N,O-bis(trimetilsili)trifluoracetamina (BSTFA) s 1 % trimetilklorsilanom (TMCS), zatim su zagrijavani jedan sat na 70 °C, ohlađeni te posušeni pod blagom strujom dušika.

Prije same analize, svakom je uzorku doda-

Spoon sample CMD4 (PN-136) (Fig. 5) is a spoon with a simple outline of the socket that widens towards the recipient. It is orange in colour, with a smoothed surface, and made of clay with mineral admixtures. Dimensions: length: 8.4 cm, recipient: length 5.6 cm, depth 3.2 cm.

Spoon sample CMD5 (PN-202) (Fig. 6) is a spoon with a simple outline of the socket that widens toward the recipient and connects to it below the rim. It is grey-brown in colour, with a smooth surface, made of clay with mineral admixtures. Dimensions: preserved length 9.5 cm, han-



Sl. 6 – Žlica uzorak CMD5 (snimila, nacrtala i izradila: M. Hulina)
Fig. 6 – Spoon sample CMD5 (photo, drawing and made by: M. Hulina)

no 10 µg n-heksatriakontana (0,2 µg/µl) u 100 µl n-heksana pri čemu su uzorci premješteni u male staklene posude za autosampler.

GC i GC-MS

Svi uzorci analizirani su kombinirano plinskom kromatografijom (GC-FID) za kvantifikaciju i plinskom kromatografijom – masenom spektrometrijom (GC-MS) za identifikaciju spojeva na Agilent 5779A plinskom kromatografu s FID (flame ionisation detector) i MS (maseni spektrometar) detektorima (Agilent, Njemačka), te Gerstel MPS autosamplerom. GC je bio opremljen 30 metarskom HP-5ms Ultra Inert kolonom (Agilent, Njemačka) unutarnjeg promjera 250 µm i debljine premaza 0,25 µm. Uzorci su ubrizgani nerascijepljenim načinom na 300 °C, a FID je također održavan na istoj temperaturi. Kao plin nosač koristio se helij s protokom 1,5 ml/min. Peć GC-a početno je zadržavana na 50 °C dvije minute, a zatim se temperatura povećavala za 5 °C po minuti do 310 °C te je tu zadržana 10 minuta. Maksimalna dosegnuta temperatura je bila 325 °C na 10 minuta. Agilent 160-2615-10 splitter odvojio je uzorak u FID i MSD. FID je radio na brzini detekcija od 20 Hz. MS je radio u načinu elektronskog udara (EI; 70 eV) s rasponom skeniranja od m/z 50 do 950. Podatci su prikupljeni u MassHunter GC/MS Acquisition B.07.02.1938.

Analiza stabilnih izotopa ugljika (GC-C-IRMS)

Izabrani uzorci, s dovoljnom količinom lipida (> 5 µg/g) i koji su zadovoljavali uvjete za analizu izotopa (jasni vrhovi masnih kiselina, nekontaminirani), što su četiri uzorka žlica, analizirani su i na GC-C-IRMS-u.

Ova je analiza provedena na Delta V plus masenom spektrometru omjera izotopa uparenom s Trace GC Ultra plinskim kromatografom pomoću GC Isolink I i ConFlo IV sučelja (Thermo Scientific, Bremen, Njemačka).

Jedan µl uzorka (i izotopski standardi) injektirani su CTC Combi-Pal autosamplerom u PTV nerascijepljenom načinu na temperaturi od 80 °C koja je zadržana 30 sekundi. Za transfer uzorka injektor je zagrijavan na 300 °C brzinom 14,5 °C po sekundi i temperatura je zadržana 2 minute. Nakon toga injektor je zagrijavan do 350 °C zbog čišćenja, te je primijenjen protok od 20 ml/min. Kao plin nosač upotrebljavan

dle socket length: 1.5 cm, recipient: preserved: 7x7.5 cm.

Lipid extraction

Organic residue analysis (focusing on lipids) was conducted at the University of Tübingen. The commonly used extraction methodology – direct methanolic acid extraction, as described in the literature – was applied for the analysis (Correa-Ascencio, Evershed 2014).

First, each sample was ground into a powder using a mini drill, ensuring the removal of the surface layer to avoid contamination. For each sample, approximately 1 gram of powder was carefully collected from the exterior and placed in glass tubes prior to analysis. To each sample, 20 µg of n-tetratriacontane (0.2 µg/µl) was added as an internal standard for quantification, followed by 4 ml of methanol. The samples were then sonicated for 15 minutes. Next, 0.8 ml of sulfuric acid (H_2S0_4) was added, and the samples were heated at 70°C for four hours. After this, the samples were centrifuged for 5 min at 3000 rpm, and the liquid portion was transferred into clean tubes. Lipids were extracted with 3x2 ml n-hexane and filtered through a pipette containing glass wool and K_2CO_3. The resulting total lipid extracts (TLE) were divided into aliquots and dried under a nitrogen stream at 40°C. For each sample series, a blank sample and a mixture of isotopically measured standards (palmitic acid, $C_{16:0}$, and stearic acid, $C_{18:0}$) were prepared, extracted, and analysed. The samples were stored in a freezer at -20°C before further analysis. After extraction, fatty acids were obtained as fatty acid methyl esters (FAMEs).

Prior to GC-FID and GC-MS analysis, aliquots of the samples were derivatized with 40 µl of N,O-bis(trimethylsilyl)trifluoroacetamide (BSTFA) containing 1% trimethylchlorosilane (TMCS), heated for 1 hour at 70°C, cooled, and dried under a gentle nitrogen stream.

Before analysis, 10 µg of n-hexatriacontane (0.2 µg/µl) in 100 µl of n-hexane was added to each sample, and the samples were transferred to small glass vials for the autosampler.

GC and GC-MS

All samples were analysed using combined gas chromatography (GC-FID) for quantification and gas chromatography–mass spectrometry (GC-MS) for compound identification. Analyses were performed on an Agilent 5779A gas chromatograph equipped

je helij s protokom od 1,5 ml/min, a spojevi su razdvajani u koloni DB-5ms dužine 30 m, unutarnjeg promjera 0,25 mm i debljine premaza 0,25 µm (Agilent J&W, Santa Clara, US). Peć plinskog kromatografa bila je programirana na 50 °C tijekom 2 minute, zatim se temperatura povećavala do 230 °C brzinom od 5 °C u minuti, te 30 °C u minuti od 230 do 310 °C. Zadržana je 10 minuta na 310 °C.

Spojevi koji se izlučuju između 31 i 38 minuta spaljeni su na 1000 °C u reaktoru za izgaranje od CuO/NiO/Pt. Postavke instrumenta su bile: struja od 1,5 mA, elektronska energija 124 eV, visoka voltaža na 3 KV i tlak vakuuma 6 x 10^{-7} bara. Svi uzorci i standardi analizirani su u duplikatu, a standardna devijacija je bila ≤ 0,3 ‰.

Referentni plin CO_2 je kalibriran u odnosu na Vienna Pee Dee Belemnite (VPDB), te su rezultati prikazani u promilima (‰) u odnosu na VPDB standard.

Dobiveni rezultati obrađeni su u programu MSD ChemStation F.01.01.2317 (Agilent Technologies Inc., Njemačka), a za identifikaciju spojeva korištena je NIST 2014 baza podataka.

REZULTATI

Prema očekivanjima, sve su žlice sadržavale ostatke lipida, a četiri i adekvatne količine za analizu stabilnih izotopa. Rezultati su sažeti u tab. 1.

Uzorak žlice CMD1 (PN-178) sadržavao je lipide u koncentraciji od 54,4 µg/g, a prevladavale su masne kiseline – stearinsku ($C_{18:0}$) i palmitinsku kiselinu ($C_{16:0}$) koje su tipične za ostatke životinjskih masti (npr. Evershed 2008). U manjim količinama prisutne su i nezasićena $C_{18:1}$ kiselina, masne kiseline parnih lanaca s 14 i 20 atoma ugljika, neparna $C_{15:0}$, te razgranate $C_{15:0}$ i $C_{17:0}$ koje mogu ukazivati na masti preživača ili djelovanje bakterija (Christie 1978: 187–189). Vrijednost izotopa $\Delta^{13}C(C_{18:0} - C_{16:0})$ od -0,6 ‰ ($\delta^{13}C$ ($C_{16:0}$) -26,2 ‰; $\delta^{13}C$ ($C_{18:0}$) -26,8 ‰) odgovara adipoznim mastima preživača, no zbog položaja u odnosu na srednje vrijednosti i krivulju miješanja (sl. 7), ne može se isključiti mješavina masti preživača (moguće mliječne) i nepreživača.

Uzorak žlice CMD2 (PN-154) sadržavao je koncentraciju lipida 30,7 µg/g, među kojima prevladavaju masne kiseline – stearinska i palmitinska kiselina, te nezasićena $C_{18:1}$, a prisutne su i masne kiseline sa 17, 20, 22 i 24 atoma ugljika, te alkoholi $C_{16}OH$ i $C_{18}OH$ (sl. 8). Vrijednost

with both FID (flame ionisation detector) and MS (mass spectrometer) detectors (Agilent, Germany) and a Gerstel MPS autosampler. The GC was fitted with a 30-meter HP-5ms Ultra Inert column (Agilent, Germany), featuring an internal diameter of 250 µm and a coating thickness of 0.25 µm. Samples were injected in splitless mode at 300°C; the FID was maintained at the same temperature. Helium was used as the carrier gas at a flow rate of 1.5 ml/min. The GC oven temperature program began with an initial hold at 50°C for two minutes, followed by a ramp at 5°C per minute to 310°C, where it was held for 10 minutes. The maximum temperature reached was 325°C, which was also held for 10 minutes. An Agilent 160-2615-10 splitter directed the sample to both the FID and MS detectors. The FID was operated at a detection rate of 20 Hz. The MS was operated in electron impact mode (EI; 70 eV) with a scan range of m/z 50 to 950. Data acquisition was performed using MassHunter GC/MS Acquisition B.07.02.1938.

Stable Carbon Isotope Analysis (GC-C-IRMS)

Selected samples with sufficient lipid content (>5 µg/g) and meeting the conditions for isotope analysis (clear fatty acid peaks, uncontaminated) – four spoon samples in total – were analysed by GC-C-IRMS.

This analysis was performed using a Delta V plus isotope ratio mass spectrometer coupled to a Trace GC Ultra gas chromatograph, with a GC Isolink I and ConFlo IV interface (Thermo Scientific, Bremen, Germany).

1 µl of each sample (and isotopic standards) was injected via a CTC Combi-Pal autosampler in PTV unsplit mode at an initial temperature of 80°C, which was held for 30 seconds. For sample transfer, the injector was heated to 300°C at a rate of 14.5°C per second and held for 2 minutes. Subsequently, the injector was heated to 350°C for cleaning, with a flow rate of 20 ml/min applied during this step. Helium was used as the carrier gas at a flow rate of 1.5 ml/min. Compound separation was achieved using a DB-5ms column (Agilent J&W, Santa Clara, US) with a length of 30 m, an internal diameter of 0.25 mm, and a coating thickness of 0.25 µm. The gas chromatograph oven was programmed as follows: initial temperature 50°C, held for 2 minutes; increased to 230°C at a rate of 5°C per minute; and then from 230°C to 310°C at 30°C per minute, with a final hold at 310°C for 10 minutes.

Compounds eluting between 31 and 38 minutes

izotopa $\Delta^{13}C(C_{18:0} – C_{16:0})$ od 1,2 ‰ ($\delta^{13}C$ ($C_{16:0}$) -25,9 ‰; $\delta^{13}C$ ($C_{18:0}$) -24,6 ‰) odgovara mastima nepreživača, odnosno svinja (sl. 7). Prisutnost većeg vrha kiseline $C_{18:1}$ ukazuje i na moguću prisutnost biljnog ulja (Steele et al. 2010), no ova se pretpostavka ne može potvrditi.

Uzorak žlice CMD3 (PN-360), sadrži koncentraciju lipida 61,4 µg/g. Prevladavaju masne kiseline – stearinska ($C_{18:0}$), palmitinska ($C_{16:0}$), a također su prisutne $C_{18:1}$ i $C_{20:0}$, alkoholi ($C_{16}OH$ i $C_{18}OH$), alkani (C_{23}, C_{27}, C_{29}, C_{31}), te vrlo mala količina β-sitosterola. Prisutnost alkana može ukazivati na mogući vosak, bilo pčelinji ili iz listova i stabljika biljaka, no za takvu interpretaciju nedostaju dugolančane masne kiseline i alkoholi (Charters, Evershed 1997; Charters et al. 1995; Regert et al. 2001; Steele et al. 2010), dok je β-sitosterol biljni sterol koji ukazuje na moguću prisutnost biljnih ostataka. Vrijednost izotopa $\Delta^{13}C(C_{18:0} – C_{16:0})$ -1,8 ‰ ($\delta^{13}C$ ($C_{16:0}$) -27,8 ‰; $\delta^{13}C$ ($C_{18:0}$) -29,7 ‰) odgovara adipoznoj masti preživača (ovca, koza, krava) (sl. 7), no zbog prisutnosti biljnog sterola može se pretpostaviti i da se radi o miješanju životinjske masti (preživača) i biljaka.

Uzorak žlice CMD4 (PN-136) sadržavao je lipide u koncentraciji od 16,9 µg/g, među kojima su prevladavale palmitinska ($C_{16:0}$) i stearinska kiselina ($C_{18:0}$). Prisutne su masne kiseline parnih lanaca od $C_{16:0}$-$C_{24:0}$, zasićene $C_{18:1}$ i $C_{22:1}$, alkohol C14oh. Vrijednost izotopa $\Delta^{13}C(C_{18:0}$-$C_{16:0})$ 0,3 ‰ ($\delta^{13}C$ ($C_{16:0}$) -25,5 ‰; $\delta^{13}C$ ($C_{18:0}$) -25,2 ‰) odgovara mastima nepreživača (svinja) (sl. 7) (Evershed et al. 2002a; Regert 2011). Uzorak sadrži i malu količinu dehidroabietične kiseline, koja se nalazi u smoli biljaka iz roda *Pinaceae*, te je mogla završiti u keramici namjerno, iz smole, ali i slučajno prilikom procesa pečenja keramike, kuhanja ili najvjerojatnije kao kontaminacija iz okoliša (Drieu et al. 2020).

Uzorak žlice CMD5 (PN-202) sadržavao je lipide u koncentraciji 17,5 µg/g. Prevladavaju palmitinska ($C_{16:0}$) i stearinska kiselina ($C_{18:0}$), prisutna je i zasićena $C_{18:1}$, te $C_{15:0}$, $C_{17:0}$, $C_{22:0}$, $C_{24:0}$ i $C_{26:0}$. Ovaj uzorak imao je i dosta modernih kontaminacija (alkani, ftalati), te je također količina palmitinske kiselina bila premala za analizu izotopa (3,4 µg/g, nasuprot 14 µg/g stearinske kiseline). Ipak, prisutnost navedenih masnih kiselina ukazuje na to da se najvjerojatnije radilo o ostatku životinjske masti.

Ove su žlice gotovo sigurno služile za konzumaciju kuhane hrane (variva?) koja se sastojala

were combusted at 1000°C in a CuO/NiO/Pt combustion reactor. Instrument settings included a current of 1.5 mA, electron energy of 124 eV, high voltage at 3 KV, and vacuum pressure of $6x10^{-7}$ bar. All samples and standards were analysed in duplicate, with a standard deviation of ≤0.3‰.

The CO_2 reference gas was calibrated against the Vienna Pee Dee Belemnite (VPDB) standard, and the results are reported in per mille (‰) relative to VPDB.

Data were processed using the MSD ChemStation F.01.01.2317 program (Agilent Technologies Inc., Germany), with compound identification aided by the NIST 2014 database.

RESULTS

As expected, all spoons contained lipid residues, and four contained sufficient lipids for stable isotope analysis. The results are summarized in Tab. 1.

Spoon sample CMD1 (PN-178) contained lipids at a concentration of 54.4 µg/g. The predominant fatty acids were stearic ($C_{18:0}$) and palmitic ($C_{16:0}$), which are typical of animal fat remains (e.g., Evershed 2008). Smaller amounts of the unsaturated acid $C_{18:1}$, even-chain fatty acids with 14 and 20 carbon atoms, and odd-chain $C_{15:0}$ and branched $C_{15:0}$ and $C_{17:0}$ were also detected; these may indicate ruminant fat or bacterial activity (Christie 1978: 187–189). The isotope value, $\Delta^{13}C(C_{18:0}–C_{16:0})$, was -0.6‰ ($\delta^{13}C$ ($C_{16:0}$): -26.2‰; $\delta^{13}C(C_{18:0})$: -26.8‰), corresponding to ruminant adipose fat. However, given the position relative to the mean values and the mixing curve (Fig. 7), a mixture of ruminant (possibly dairy) and non-ruminant fat cannot be excluded.

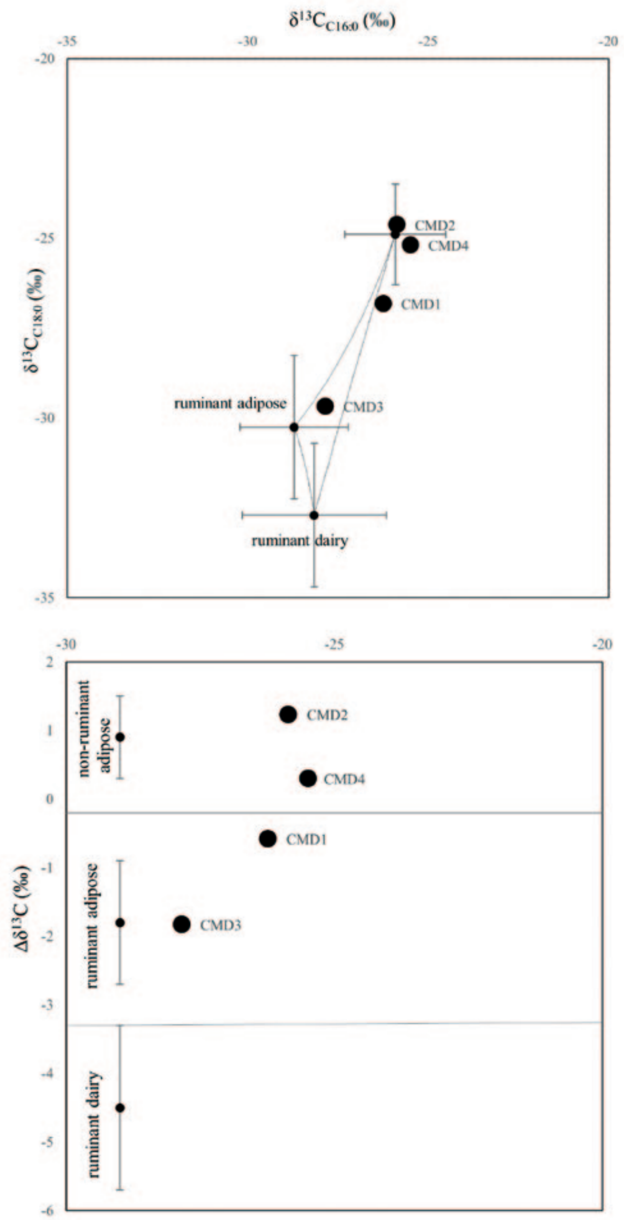
Spoon sample CMD2 (PN-154) contained a lipid concentration of 30.7 µg/g. Predominantly fatty acids include stearic and palmitic acids, as well as the unsaturated $C_{18:1}$ and fatty acids with 17, 20, 22, and 24 carbon atoms. Alcohols $C_{16}OH$ and $C_{18}OH$ were also present (Fig. 8). The isotope value $\Delta^{13}C(C_{18:0}–C_{16:0})$ of 1.2‰ ($\delta^{13}C$ ($C_{16:0}$): -25.9‰; $\delta^{13}C$ ($C_{18:0}$): -24.6‰) corresponds to non-ruminant fats, i.e., pig (Fig. 7). The presence of a larger peak of $C_{18:1}$ acid also suggests the possible presence of vegetable oil (Steele et al. 2010), although this assumption cannot be confirmed.

Spoon sample CMD3 (PN-360) contains a lipid concentration of 61.4 µg/g. Predominant fatty acids include stearic ($C_{18:0}$), palmitic ($C_{16:0}$), $C_{18:1}$, and $C_{20:0}$. Alcohols ($C_{16}OH$ and $C_{18}OH$) and alkanes

Uzorak / sample	Razdoblje / time period	Dio posude / vessel part	Vrsta posude / vessel type	Površina i faktura / surface and fabric	Kol. lipida / amount of lipids) (µg/g)	Lipidi / lipids	$\delta^{13}C$ $C_{16:0}$ (‰)	$\delta^{13}C$ $C_{18:0}$ (‰)	$\Delta^{13}C$ ($C_{18:0}$–$C_{16:0}$) (‰)	Sadržaj / content
CMD1	Eneolitik – lasinjska kultura / Eneolithic – Lasinja culture	Recipijent / recipient	Žlica / spoon	Neglačana, prijelazna / Unpolished, medium	54,4	Masne kiseline / FA: parne / even $C_{14:0}$–$C_{20:0}$, $C_{15:0}$, $C_{18:1}$; razgranate / branched C_{15}, C_{17}; alkani / alkanes: C_{25}, C_{27}; ostalo / other: ftalat / phthalate	-26,2	-26,8	-0,6	Adipozna mast nepreživača + preživača / ruminant + non-ruminant adipose fat
CMD2	Eneolitik – lasinjska kultura / Eneolithic – Lasinja culture	Recipijent / recipient	Žlica / spoon	Neglačana, prijelazna / Unpolished, medium	30,7	Masne kiseline / FA: $C_{16:1}$, $C_{16:0}$, $C_{17:0}$, $C_{18:2}$, $C_{18:1}$, $C_{18:0}$, $C_{20:0}$, $C_{22:1}$; $C_{22:0}$, $C_{24:0}$; alkoholi / OH: C_{16}, C_{18}; ostalo / other: ftalat / phthalate	-25,9	-24,6	1,3	Adipozna mast svinje / non ruminant adipose (pig) fat
CMD3	Eneolitik – lasinjska kultura / Eneolithic – Lasinja culture	Recipijent / recipient	Žlica / spoon	Neglačana, prijelazna / Unpolished, medium	61,4	Masne kiseline / FA: $C_{16:0}$, $C_{18:1}$, $C_{18:0}$, $C_{20:0}$; alkoholi / OH: C_{16}, C_{18}; alkani / alkanes: C_{23}, C_{27}, C_{29}, C_{31}; steroli / steroles: β-sitosterol; ostalo / other: ftalat / phthalate	-27,8	-29,7	-1,8	Adipozna mast preživača + biljka / ruminant adipose fat + plant
CMD4	Eneolitik – lasinjska kultura / Eneolithic – Lasinja culture	Recipijent / recipient	Žlica / spoon	Neglačana, prijelazna / Unpolished, medium	16,9	Masne kiseline / FA: parne / even $C_{16:0}$–$C_{24:0}$, $C_{18:2}$, $C_{18:1}$, $C_{22:1}$; alkoholi / OH: C_{14}; ostalo / other: dehidroabietična kiselina / dehydroabietc acid, ftalat / phthalate	-25,5	-25,2	0,3	Adipozna mast svinje / non-ruminant (pig) adipose fat
CMD5	Eneolitik – lasinjska kultura / Eneolithic – Lasinja culture	Recipijent / recipient	Žlica / spoon	Neglačana, prijelazna / Unpolished, medium	17,5	Masne kiseline / FA: $C_{16:0}$, $C_{18:1}$, $C_{18:0}$, $C_{15:0}$, $C_{17:0}$, $C_{22:0}$, $C_{22:1}$, $C_{24:0}$, $C_{26:0}$; alkoholi / OH: C_{14}, C_{18}; alkani / alkanes: C_{17}; ostalo / other: ftalati / phthalate	-	-	-	Životinjska mast? + kontaminacije (plastifikatori) / animal fat? – contanimation

Tab. 1 – Popis analiziranih uzoraka s opisom, sadržajem lipida i vrijednostima izotopa (CMD = Čepinski Martinci Dubrava) (izradila: M. Hulina)

Tab. 1 – List of analysed samples with descriptions, lipid content, and isotope values (CMD = Čepinski Martinci Dubrava) (made by: M. Hulina)



Sl. 7 – Graf prikazuje: $\delta^{13}C$ vrijednosti (gore) za masne kiseline $C_{16:0}$ i $C_{18:0}$ iz uzoraka CMD1–4 sa srednjim vrijednostima i rasponom 1 SD za adipozne masti preživača, nepreživača i mliječne masti; $\Delta^{13}C$ vrijednosti (dolje) za iste uzorke. Srednje vrijednosti dobivene su iz referentnih modernih masti iz globalne baze podataka (prema: Debono Spiteri 2012; Dudd 1999; Dunne 2014; Gregg et al. 2009; Outram et al. 2009; Pääkkönen et al. 2020; Spangenberg et al. 2006) (izradila: M. Hulina)
Fig. 7 – Graph showing $\delta^{13}C$ values (top) for fatty acids $C_{16:0}$ and $C_{18:0}$ from samples CMD1–4, with mean values and 1 SD range for ruminant and non-ruminant adipose fat and milk fat; $\Delta^{13}C$ values (bottom) for the same samples. Mean values were obtained from reference modern fats in a global database (after: Debono Spiteri 2012; Dudd 1999; Dunne 2014; Gregg et al. 2009; Outram et al. 2009; Pääkkönen et al. 2020; Spangenberg et al. 2006) (made by: M. Hulina)

(C_{23}, C_{27}, C_{29}, C_{31}) are also present, as well as a very small amount of β-sitosterol. The presence of alkanes may indicate possible wax, either beeswax or plant wax from leaves and stems; however, for such an interpretation, long-chain fatty acids and alcohols are absent (Charters, Evershed 1997; Charters et al. 1995; Regert et al. 2001; Steele et al. 2010), while β-sitosterol is a plant sterol, indicating the possible presence of plant residues. The isotope value $\Delta^{13}C(C_{18:0}–C_{16:0})$ of -1.8‰ ($\delta^{13}C$ ($C_{16:0}$): -27.8‰; $\delta^{13}C$ ($C_{18:0}$): -29.7‰) corresponds to ruminant adipose fat (sheep, goat, cow) (Fig. 7). However, due to the presence of a plant sterol, it can also be assumed that the sample contains a mixture of animal fat (ruminants) and plants.

Spoon sample CMD4 (PN-136) contained lipids at a concentration of 16.9 µg/g, dominated by palmitic ($C_{16:0}$) and stearic ($C_{18:0}$) acids. Even-chain fatty acids from $C_{16:0}$ to $C_{24:0}$, saturated $C_{18:1}$ and $C_{22:1}$, and alcohol $C_{14}OH$ were also present. The isotope value $\Delta^{13}C(C_{18:0}–C_{16:0})$ of 0.3‰ ($\delta^{13}C$ ($C_{16:0}$): -25.5‰; $\delta^{13}C$ ($C_{18:0}$): -25.2‰) corresponds to non-ruminant (pig) fats (Fig. 7) (Evershed et al. 2002a; Regert 2011). The sample also contained a small amount of dehydroabietic acid, which is found in the resin of plants from the *Pinaceae* family and could have been introduced intentionally – from the resin – or accidentally during ceramic firing, cooking, or, most likely, as environmental contamination (Drieu et al. 2020).

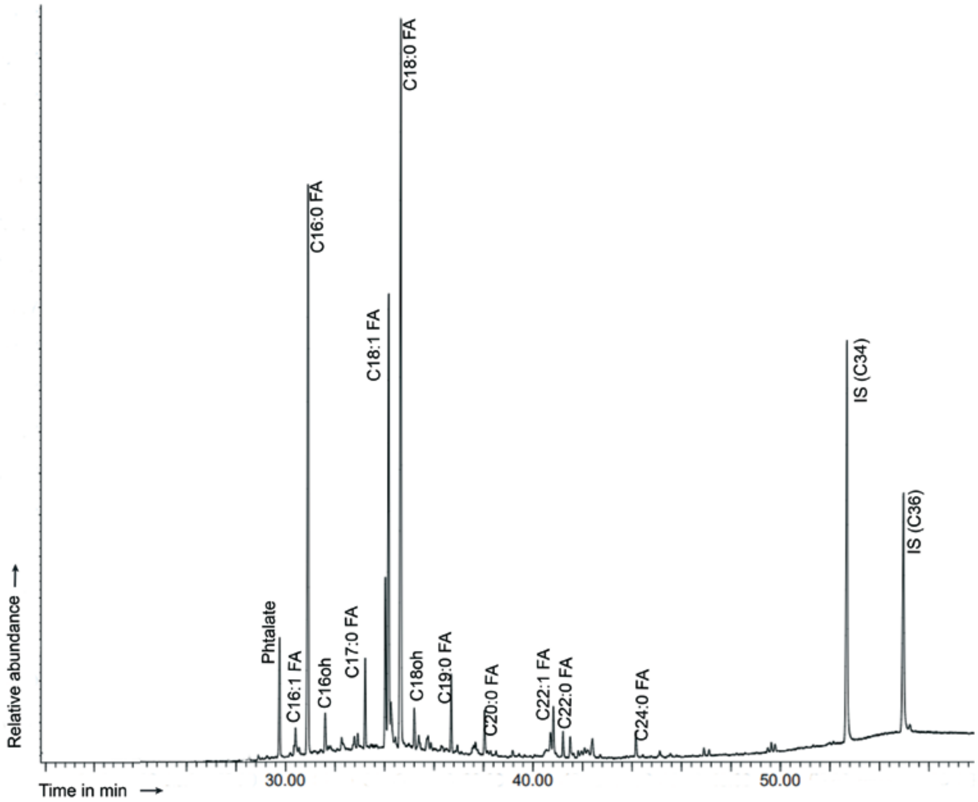
Spoon sample CMD5 (PN-202) contained lipids at a concentration of 17.5 µg/g. Palmitic ($C_{16:0}$) and stearic ($C_{18:0}$) acids predominated; saturated $C_{18:1}$, as well as $C_{15:0}$, $C_{17:0}$, $C_{22:0}$, $C_{24:0}$, and $C_{26:0}$, were also present. This sample also showed evidence of significant modern contamination (alkanes, phthalates), and the amount of palmitic acid was too low for reliable isotope analysis (3.4 µg/g, compared to 14 µg/g of stearic acid). However, the presence of these fatty acids most likely indicates the remains of animal fat.

These spoons were almost certainly used for consuming cooked food (stew?) consisting of ruminant and non-ruminant meat (pig), sometimes with added vegetable matter.

No traces of dairy fat, cereals, or fish were detected.

DISCUSSION

The results of lipid analysis on the spoons from Čepinski Martinci demonstrate excellent lipid preservation – traces were found on all five samples. Although some contamination was present,



Sl. 8 – Djelomični kromatogram uzorka CMD2 (FA = masna kiselina, oh = alkohol, IS = unutarnji standard) (izradila: M. Hulina)
Fig. 8 – Partial chromatogram of sample CMD2 (FA = fatty acid, oh = alcohol, IS = internal standard) (made by: M. Hulina)

od mesa preživača i nepreživača (svinje), ponekad s biljnim dodatcima.

Tragovi mliječnih masti, žitarica ili ribe nisu pronađeni.

RASPRAVA

Rezultati analize lipida na žlicama iz Čepinskih Martinaca pokazali su odličnu očuvanost lipida – tragovi su pronađeni na svih pet uzoraka, nažalost uz nešto kontaminacija, koje ipak u većini slučajeva nisu smetale interpretaciji.

Rezultati potvrđuju da su se ove žlice upotrebljavale za rukovanje (premještanje iz jedne posude u drugu) ili direktnu konzumaciju hrane u najvjerojatnije tekućem ili kašastom obliku (npr. različite juhe i variva) čiji je glavni sastojak (ili barem onaj koji je ostavio najjači trag) bio životinjskog podrijetla (meso). Upotrebljavale su se najvjerojatnije često, svakodnevno, te je zato i sačuvan trag lipida.

Najčešća pronađena tvar su životinjske masti, a one su karakterizirane prisutnošću masnih kiselina među kojima prevladavaju palmi-

in most cases it did not interfere with interpretation.

The results confirm that these spoons were used for the manipulation (transferring food from one container to another) or direct consumption of food, most likely in liquid or mushy form, such as various soups and stews. The main ingredient – or at least the one leaving the strongest trace – was of animal origin (meat). The spoons were most likely used frequently, on a daily basis, which explains the preservation of lipid residues.

The most commonly identified substance is animal fat, characterized by the presence of dominant fatty acids, especially palmitic ($C_{16:0}$) and stearic acid ($C_{18:0}$) (e.g., Evershed et al. 1997; 2002a; 2002b).

Furthermore, the presence of $C_{15:0}$ and $C_{17:0}$ straight-chain and branched fatty acids in the CMD1 and CMD5 spoon samples may indicate ruminant fat or bacterial activity (Christie 1978; Evershed 2008).

The origin of animal fat was further clarified through $\delta^{13}C$ stable isotope analysis of palmitic and stearic acids. Differences in $\delta^{13}C$ values arise

tinska ($C_{16:0}$) i stearinska kiselina ($C_{18:0}$) (npr. (Evershed et al. 1997; 2002a; 2002b).

Nadalje, prisutnost $C_{15:0}$ i $C_{17:0}$ masnih kiselina ravnih i razgranatih lanaca u uzorcima žlica CMD1 i CMD5, mogu biti pokazatelji prisutnosti masti preživača ili bakterijskog djelovanja (Christie 1978; Evershed 2008).

Podrijetlo životinjskih masti pobliže je određeno i analizom stabilnih izotopa $\delta^{13}C$ iz palmitinske i stearinske kiseline. Razlike u $\delta^{13}C$ vrijednostima postoje zbog različitog metabolizma ugljika i sinteze masnih kiselina kod primjerice adipozne masti nepreživača i preživača ili mliječne masti preživača, dok upotreba $\Delta^{13}C$ vrijednosti ($\delta^{13}C_{18:0}$ – $\delta^{13}C_{16:0}$) u odnosu na $\delta^{13}C$ vrijednost palmitinske kiseline ($C_{16:0}$) umanjuje utjecaj varijacija nastalih konzumacijom C3 i C4 biljaka (Copley et al. 2003; Dudd, Evershed 1998).

Žlice iz Čepinskih Martinaca pokazale su prisutnost masti i nepreživača (svinja) i preživača (krava, koza/ovca), ponekad i na istoj žlici, pokazujući da su se upotrebljavale za rukovanje i konzumaciju jela s obje vrste mesa, te da su se obje vrste mesa upotrebljavale za kuhanje juha, variva ili kaša.

U jednom slučaju u uzorku (CMD3) je prisutan mogući ostatka voska iz listova biljaka (uz životinjsku mast). Biljni voskovi sadrže dugolančane alkohole (C_{22} – C_{32}), alkane (C_{23} – C_{33}), masne kiseline ($C_{16:0}$ – $C_{30:0}$) i ketone (Evershed et al. 1997; Tulloch 1976; Steele et al. 2010). Dominacija C_{29} alkana je potencijalni marker za biljke iz roda *Brassica*, uz nonakosan-15-on i nonakosan-15-ol koji nisu pronađeni u ovom uzorku, a prisutnost alkana C_{31}, također uz keton hentriacontane-16-on koji nije pronađen u uzorku, je potencijalni marker za biljke iz roda *Allium*, moguće poriluk (Charters et al. 1995; Charters, Evershed 1997; Rhee et al. 1998). Također je prisutna i mala količina β-sitosterola koji potvrđuje da se doista radilo o ostatku biljaka, no iz prisutnih spojeva, ne može se sa sigurnošću utvrditi koja je to biljka bila.

Prisutnost životinjske masti u istom uzorku lijepo ilustrira da su se iste posude, u ovom slučaju žlice upotrebljavale za konzumaciju hrane iz životinjskih i biljnih izvora, istovremeno ili zasebno, u različito vrijeme.

U svojoj su prehrani lasinjske zajednice upotrebljavale meso preživača (najviše goveda, ali i ovca i koza), svinja, ponekad i divljih životinja, u kombinaciji s različitim žitaricama, mahunarka-

from variations in carbon metabolism and fatty acid synthesis between non-ruminant adipose fat, ruminant adipose fat, and dairy fats. The use of $\Delta^{13}C$ values ($\delta^{13}C_{18:0}$ – $\delta^{13}C_{16:0}$) in relation to the $\delta^{13}C$ value of palmitic acid ($C_{16:0}$) minimizes the influence of variations caused by the consumption of C3 and C4 plants (Copley et al. 2003; Dudd, Evershed 1998).

The spoons from Čepinski Martinci revealed residues from both non-ruminants (pigs) and ruminants (cows, goats/sheep), sometimes in the same spoon, indicating that they were used for consuming or preparing dishes containing both meats and that both meats were used for cooking soups, stews, or porridges.

In one case (sample CMD3), a possible residue of plant leaf wax (alongside animal fat) was identified. Plant waxes contain long-chain alcohols (C_{22}–C_{32}), alkanes (C_{23}–C_{33}), fatty acids ($C_{16:0}$–$C_{30:0}$), and ketones (Evershed et al. 1997; Tulloch 1976; Steele et al. 2010). The dominance of C_{29} alkane suggests a potential link to plants of the genus *Brassica*; however, key markers like nonacosan-15-one and nonacosan-15-ol were absent. Similarly, the presence of C_{31} alkane could indicate plants of the genus *Allium*, possibly leek, but the associated ketone hentriacontane-16-one was not detected (Charters et al. 1995; Charters, Evershed 1997; Rhee et al. 1998). A small amount of β-sitosterol confirms plant remains, though the specific plant cannot be definitely identified from the available compounds.

The coexistence of animal fat and plant residues in this sample demonstrates that the same spoons were used for consuming foods of both animal and plant origin – either simultaneously or at different times.

The Lasinja communities' diet, as inferred from organic residue analysis, included ruminant meat (primarily cattle, with sheep and goats), pork, and occasionally wild game. These were supplemented by cereals, legumes, fruits, and likely leafy vegetables.

The use of dairy, although known since the Neolithic and confirmed by organic residue analyses as well as indirectly by animal bone evidence, was not recorded on the spoons from Čepinski Martinci.

In addition to the types of foods eaten with Lasinja culture spoons, it is possible to make inferences about the manner in which food was consumed and served. The spoons had handles made of organic material – most likely wood – which

ma, voćem, a analize organskih ostataka tome dodaju i vjerojatno lisnato povrće.

Upotreba mlijeka, iako je postojala već u neolitiku, što je poznato i iz analiza organskih ostataka i indirektno iz analiza kostiju životinja, nije zabilježena na žlicama iz Čepinskih Martinaca.

Osim vrste hrane koja se jela žlicama lasinjske kulture, možemo izvući zaključke i o načinu konzumacije hrane i posluživanja. Žlice su imale drške od nekog organskog materijala, vjerojatno drveta, koje se nisu sačuvale. Mogle su se koristiti ili da se sadržaj prenese iz velike u malu posudu za individualnu konzumaciju, iz koje se onda moglo jesti primjerice rukom, ili za grabiljenje iz velikih posuda i jesdenje žlicama. Poznato je iz etnografskih izvora da su primjerice u Sloveniji još u 19. i čak i sredinom 20. st. ljudi jeli direktno iz većih zajedničkih posuda drvenim žlicama ili rukama (Kramberger 2015: 241–242). Moguće je da je način na koji se žlica koristila – grabljenje u drugu posudu (kao suvremena zaimača) ili za konzumaciju hrane ovisio o veličini same žlice, veličini posude iz koje se hrana grabila, te dobi osobe koja je žlicu upotrebljavala – odrasla osoba ili dijete.

ZAKLJUČAK

Kemijske analize organskih ostataka iz keramike dobar su alat pomoću kojeg je moguće dobiti dodatne informacije o upotrebi određenih oblika posuda, a posredno i o prehrani i privredi zajednica u prošlosti. Sasvim je logično da su se žlice upotrebljavale u kontekstu prehrane i rukovanja hranom, no zanimljivo je vidjeti koje vrste hrane su ostavile tragove na njima. Ovdje analizirane žlice lasinjske kulture upotrebljavane su za grabljenje, serviranje ili kao pribor za jelo, najvjerojatnije tekuće hrane poput variva, juha ili kaša od mesa nepreživača (svinja) i preživača (krava, koza, ovca), uz dodatke biljaka (žitarica i drugih). Biljni ostaci ostavljaju slabiji trag, pa često nisu dobro vidljive u analizama organskih ostatka, iako ostatci samih biljaka na nalazištu potvrđuju njihovu upotrebu. Žlice su vjerojatno često upotrebljavane za direktnu konzumaciju jer je trag lipida od hrane koja nije kuhana ili je u njima ostala samo kratko često slabiji (Charters et al. 1993; Šoberl et al. 2014), a ovdje su lipidi dobro očuvani.

Ovaj rad čini mali, no značajan doprinos rezultatima analiza organskih ostataka s hrvatskih

have not been preserved. They may have been used either to transfer food from a large container to a smaller one for individual consumption (after which the food could be eaten by hand), or to scoop food from large containers and eat it with the spoon itself. For example, ethnographic sources from Slovenia show that, even in the 19th and mid-20th century, people ate directly from larger communal containers using wooden spoons or their hands (Kramberger 2015: 241–242). The way a spoon was used – whether for scooping into another container (like a modern spoon) or for direct consumption – likely depended on the size of the spoon, the size of the container, and the age of the person using the spoon (adult or child).

CONCLUSION

Organic residue analysis of pottery is a valuable tool for obtaining additional information about the use of specific vessel shapes and, indirectly, about the diet and economy of past communities. While it is logical to assume that spoons were used in the context of diet and food manipulation, it is particularly interesting to observe what types of food left traces on them. The Lasinja spoons analysed in this study were used for scooping, serving, or eating, most likely of liquid foods such as stews, soups or porridges made from the meat of non-ruminants (pigs) and ruminants (cows, goats, sheep), with the addition of plants (cereals and others). These plant materials leave a weaker trace and are often undetectable in organic residue analysis, although plant remains found at the site confirm their use. The spoons were probably used frequently for direct consumption, since lipid traces from food that was not cooked or remained in them only briefly are typically weaker (Charters et al. 1993; Šoberl et al. 2014), while here the lipids are well preserved.

This paper contributes a small but significant addition to the body of organic residue analyses from Croatian sites, which are currently limited in number and have not previously included Lasinja pottery.

Further research is needed on a larger number of Lasinja spoons, as well as on a larger number of vessels from Čepinski Martinci and other Croatian sites.

To achieve a more comprehensive understanding of the Lasinja community's diet at Čepinski Martinci, it will be essential to integrate zooar-

nalazišta koji su za sada malobrojni, a na materijalu lasinjske kulture do sada neobjavljeni.

Potrebna su daljnja istraživanja većeg broja lasinjskih žlica, kao i većeg broja posuda iz Čepinskih Martinaca, ali i drugih hrvatskih nalazišta.

Da bi se dobila potpunija slika o prehrani zajednice lasinjske kulture iz Čepinskih Martinaca, biti će ključno integrirati zooarheološke podatke s analizom organskih ostataka na keramičkim posudama i već poznatim botaničkim podacima.

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chaeological data with organic residue analysis of ceramic vessels and existing botanical evidence.

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Prijevod Translation **MATEJA HULINA**
Lektura Proofreading **MARKO MARAS**

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